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# CARBON/CARBONATE ANALYSIS OF ROCK/GAS PRONE SANDSTONES FROM THE SYDNEY COALFIELD

P. Cain
Cape Breton Coal Research Laboratory

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# CARBON/CARBONATE ANALYSIS OF ROCK/GAS PRONE SANDSTONES FROM THE SYDNEY COALFIELD

by

Peter Cain*

## ABSTRACT

Results of free carbon and fixed carbon analysis of sandstone samples from rock/gas prone locations at No. 26 Colliery are presented.

No correlation between free carbon or carbon dioxide content (assumed to be in the form $CaCO_3$ or $MgCO_3$) and the origin of the samples - their proximity to rock/gas bursts - could be determined conclusively.

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*Research Scientist, Cape Breton Coal Research Laboratory, CRL, CANMET, Energy, Mines and Resources Canada, Sydney.

# ANALYSE DE LA TENEUR EN CARBONE/CARBONATE DU GRÈS PRÉDISPOSÉ AUX COUPS DE TOIT ET DE GAZ À LA HOUILLÈRE LINGAN

par

Peter Cain*

RÉSUMÉ

Les résultats d'analyse de la teneur en carbone libre et en carbone fixe contenue dans les échantillons de grès provenant d'endroits prédisposés aux coups de toit et de gaz à la houillère N° 26 sont présentés dans le présent rapport.

Aucune corrélation n'a pu être déterminée de façon concluante entre la teneur en carbone libre et en bioxyde de carbone (considérés comme étant sous la forme de $CaCO_3$ ou $MgCO_3$) et l'origine des échantillons, soit leur proximité aux coups de toit et de gaz.

*Chercheur scientifique, Laboratoire de recherche sur le charbon de Cap-Breton, LRC, CANMET, Énergie, Mines et Ressources Canada, Sydney.

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## INTRODUCTION

Sandstone/methane outbursts occurring at No. 26 Colliery, Glace Bay, Nova Scotia in 1985 were haphazardly distributed in a massive sandstone overbank deposit. An initial attempt to explain the random occurrence of bursts was that the methane existed in the sandstone in pockets, possibly prevented from migration by diagenetic carbonates (derived from overlying limestones) which created porosity/permeability barriers.

Free carbon/fixed carbon analyses were conducted on six sandstone samples collected from various locations at No. 26 Colliery. The test method and results are given below.

## TEST METHOD

Each sandstone sample was crushed to -60 mesh prior to testing. Two test methods were used: the weight loss method and the derived gas method.

For the weight loss method, a small amount of sample was placed in a silica crucible, weighed and then heated in a muffle furnace at 500 - 530°C for two hours. Organic carbon is oxidised and magnesium carbonate is decomposed under these conditions. The samples were reweighed and then heated for one hour at 1000° to calcine the calcium carbonate, after which the final sample weight is determined.

In the derived gas method, a sample of crushed (-60 mesh) material is reacted with hydrochloric acid. Both magnesium and calcium carbonates are broken down and the volume of carbon dioxide released is measured.

Six samples from various locations were tested, as indicated in Table 1. Test results are given in the following section.

Table 1 - Sample locations and tests conducted

| Sample # | Origin | Test Method | |
|---|---|---|---|
| | | Weight Loss | Derived Gas |
| 1 | 'disced' sandstone core | ✓ | ✓ |
| 2 | 'burst' sandstone | ✓ | ✓ |
| 3 | sandstone core | ✓ | ✓ |
| 4 | sandstone core | ✓ | ✓ |
| 5 | 'burst' sandstone | | ✓ |
| 6 | 'burst' sandstone | | ✓ |

## RESULTS

Table 2 gives the results obtained from the tests.

Table 2 - Results

| Sample # | Weight Loss Method | | Derived Gas Method | | |
|---|---|---|---|---|---|
| | @ 500°C (organic carbon + $MgCO_3$) | @ 1000°C ($CaCO_3$) | % $CO_2$, ± 0.1% | Theoretical Carbonate % (100% $MgCO_3$) | (100% $CaCO_3$) |
| 1 | 1.40 | 1.60 | 1.4 | 2.7 | 3.2 |
| 2 | 2.11 | 1.28 | 1.2 | 2.24 | 2.66 |
| 3 | 2.40 | 1.03 | 1.6 | 3.01 | 3.57 |
| 4 | 1.97 | 0.96 | 1.1 | 2.05 | 2.43 |
| 5 | - | - | 0.8 | 1.51 | 1.79 |
| 6 | - | - | 1.1 | 2.05 | 2.44 |

The carbonate content of the sandstone cannot be determined exactly if it is assumed that either $MgCO_3$ or $CaCO_3$ may be present, but maximum and minimum values of carbonate can be derived by assuming 100% $CaCO_3$ or 100% $MgCO_3$, respectively.

Due to the different atomic weights of Mg and Ca, the theoretical weight percent of $CO_2$ in $MgCO_3$ and $CaCO_3$ is 52.20% or 43.97%, respectively. The corresponding carbonate percentages derived from the data are also illustrated in Table 2.

## DISCUSSION

Of the six samples, four were tested by both methods. The 'disced' sandstone core is assumed to be burst-prone (discing is an important characteristic of burst-prone sandstones in Europe). The results do not show any consistent differences between the burst sandstone (1,2,5,6) and the ordinary sandstones (3,4) from either method of determining carbonate content.